Industrial Waste Diversion Program

Final Reports #5

ENVIRONMENTAL FEASIBILITY STUDY FOR TOSCAN SKIN & HYDE CO.

JUNE 1991

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INDUSTRIAL WASTE DIVERSION PROGRAM
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Report prepared for :

Waste Management Branch
Ontario Ministry of the Environment

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ENVIRONMENTAL

FEASIBILITY STUDY

FOR TOSCAN SKIN & HYDE CO.

Report prepared for:

Waste Management Branch
Ontario Ministry of the Environment

In consultation with

Rupke & Associates Ltd.
Environmental Engineers

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DISCLAIMER

This report is in partial fulfillment of conditions of a grant given to Toscan Skin & Hide Ltd. by the Ministry of the Environment under the Industrial Waste Diversion Program. The report was prepared by Rupke & Associates Ltd. for Toscan Skin & Hide Ltd. and documents results of work for which the Ministry of the Environment provided financial assistance.

The views and ideas expressed in this report are those of the authors and do not reflect necessarily the views and policies of the Ministry of the Environment, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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1 INTRODUCTION

Toscan Skin & Hide Ltd. is a Canadian owned private company wishing to establish a shearling tannery on part of lots 23 and 24, Concession 2 of Hope Township in the County of Northumberland. The site is located at the South West Corner of Highway 401 and Wesleyville Road and is currently rented to adjacent farmers for use as farmland.

The Tannery will produce finished sheep and lamb skin with the wool left intact on one side and a sueded finish on the other. The intended use of the product is for production of garments.

Rupke & Associates Ltd. (RAL) were retained in the spring of 1988 to product a feasibility study to address the following issues:

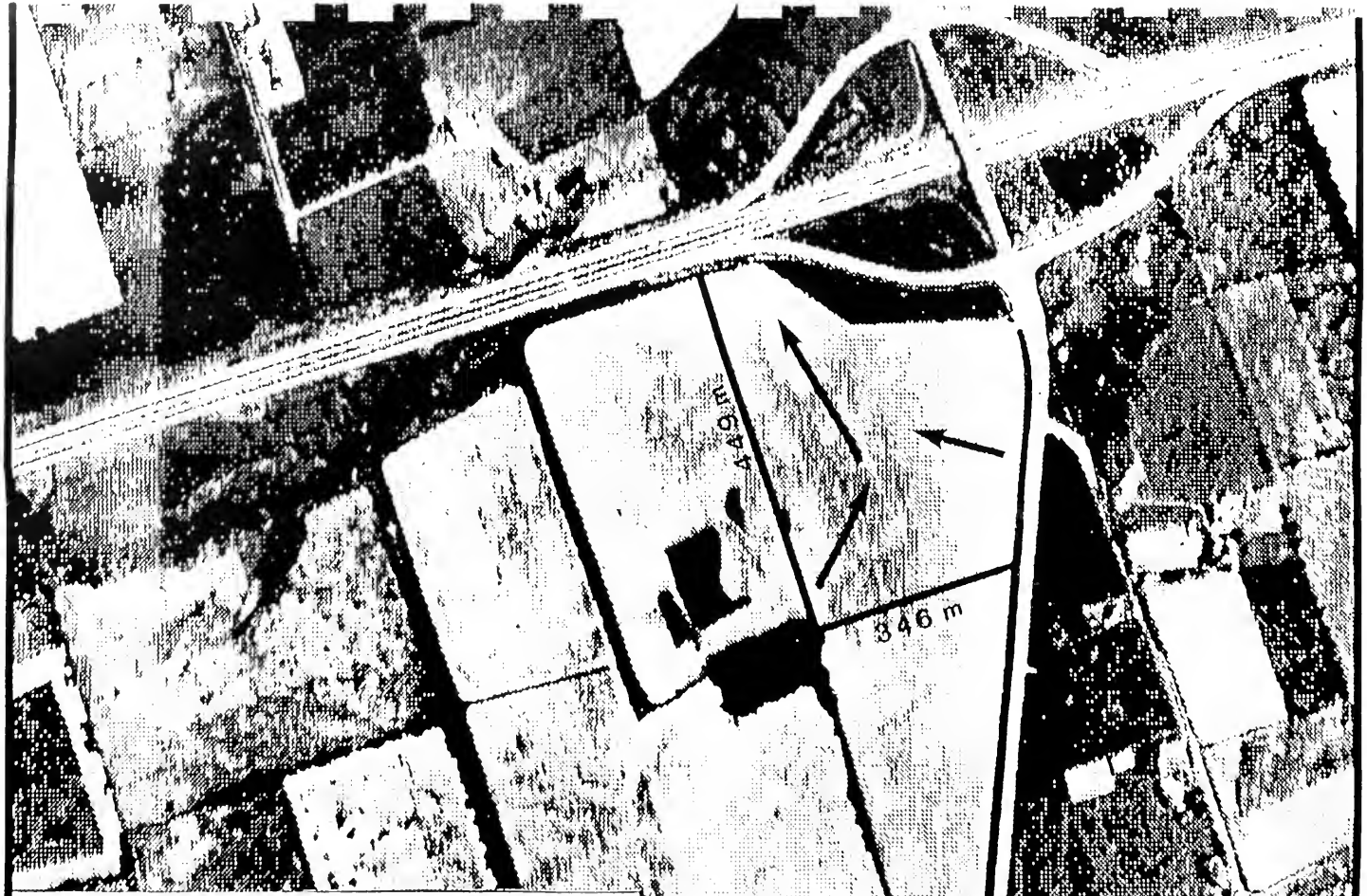
1. Availability of a reliable water source.
2. Determination of probable wastewater flows and characteristics with an emphases on flow minimization.
3. Potential processes for soak water reuse (salt contaminated) within the subsequent wet processing steps.
4. Potential techniques of salt recovery from the final wastewater stream.
5. Chromium recovery and reuse from the spent chrome tanning liquors and subsequent wringing liquors or washwaters.
6. Techniques for the on-site disposal of the residual wastewater.

It is recognized that the site must provide a suitable water supply as well as be suitable to handle all the wastewater produced by the production processes utilized in the Tannery.

2 THE SITE

Figure 1 is a site plan of the proposed site. The site is intersected by a valley running North South across the site. The site drains to the North through a culvert under Highway 401 and ultimately into a small watercourse leading to Lake Ontario. The site has an area of approximately 15.5 hectares and is located in part of lots 23 and 24, Concession 2, Township of Hope in the County of Northumberland.

The surficial soil on the site is Newcastle Loam underlain by approximately 10 m of a reddish brown clay and stone mixture.



TOSCAN SKIN & HIDE LTD.

SCALE:	APPROVED BY:	DRAWN BY
DATE: JUNE/88		REVISED

SITE PLAN

DRAWING NUMBER

3 WATER SUPPLY

Based on the available well water records (Appendix A) and discussions with local well drillers it was found that adjacent properties are supplied by drilled wells penetrating into water bearing sand and gravel strata approximately 20 to 40 metres below the surface. In general the sites are underlain with 10+ metres of clay/stone mixture which is highly impermeable and unsuitable for the development of a water supply due to the extremely low rate of water flow through the strata. The lower gravel strata have proven to be a reliable domestic water supply with minimal drawdown at the test rates of from 5 to 10 gpm. It is anticipated that the proposed site will prove to have similar characteristics and be able to supply a reliable water source in the range of 10 to 15 gpm without interfering with other water supplies in the immediate vicinity. A detailed hydrogeological study will be required in order to determine the exact conditions on the site.

4 WASTEWATER VOLUME AND CONCENTRATIONS

The water utilization in a tannery of this type is directly related to the nature of the production equipment utilized to produce the final product as well as the steps involved in the tanning process.

The process steps to arrive at a final product are well established in the shearling tannery industry and cannot be appreciably altered without affecting the nature and quality of the final product. When starting with a salted raw skin the following water based steps are involved in the process:

	Volume used L
1. Soaking	
2. Rinsing	6700
3. Pickling	
4. Degreasing	6700
5. Washing	5500
6. Tanning	5500
7. Washing	5500
8. Neutralizing	
9. Retanning --to-- dry processing	5500
10. Wetting-back -from- dry processing	1000
11. Washing	
12. Drying --to-- dry processing	5500

If the skin are purchased as a crust skin the wet processes can be considerably reduced to the following:

		Volume used L
1.	Washing	5500
2	Tanning	5500
3.	Washing	5500
4.	Neutralization	
5.	Retanning --to-- dry processing	5500
6.	Wetting back -from- dry processing	1000
7.	Washing	
8.	Dyeing --to-- dry processing	5500

Both alternatives, salted raw skins and crust skins, will be considered during this feasibility study. For design purposes it is proposed to use a production level of 500 skins/day 5 days a week as a design basis.

The sheepskin or shearling tanning industry in Canada is very small and generally utilizes old production equipment. RAL has studied several similar facilities in the past and found water utilization to be higher than similar sized leather tanneries. Our best estimate of water consumption using this older production equipment would be 100,000 to 150,000 L/day for a production level of 500 skins/day when using salted raw skins. Even a preliminary analysis of the situation convinced us that this site could not accommodate those levels of water supply or wastewater disposal. It was obvious that a significant effort was required to minimize water utilization. Similar efforts have been ongoing in European Tanneries for the past 20 years and a great amount of expertise has been developed in the area of water use minimization.

Two basic types of production equipment have been developed in Europe to reduce the water consumption in tanneries. They are the Y drum and the hide processor drum. Appendix B contains technical data from three companies which produce low water usage tanning equipment. The "Tannox" by RIAT, Appendix B1 and the "Unimatik", Appendix B2 by Billeri Riccardo are both Y drums while Challenge Cook Bros. Inc. manufacture the "Challenge Hide Processor", Appendix B3. Approximately seven tanneries using this equipment to produce tanned sheepskin were visited in Europe. In all cases, similar data on water consumption was gathered. The total water used to produce the final product was significantly reduced by from 30 to 60% depending upon the initial processing equipment. When compared to the use of open paddles a 60% water reduction can be anticipated. When

compared to closed wooden single compartment drums 30% reduction is more commonly reported.

One unanticipated advantage of the Y drum and hide processor is the more efficient use of chemicals. This efficiency comes about as a result of reduced water volumes as well as increased uptake of the chemicals by the skin due to better mixing and process control in the newer production equipment. The 15 to 25% reduction in chemical usage frequently related to a 70 to 80% reduction in chemical loss with the effluent water.

Based on a daily production rate of 500 sheepskins at an average weight of 5.0 Kg/skin the estimated water usage is shown in Table I.

TABLE I
ESTIMATED WATER USAGE L/DAY
BASIS 2500 Kg/day of Sheepskin

EQUIPMENT	SALTED RAW HIDE	CRUST
Hide Processor	50,000	30,000
Y Drum and Paddle	90,000	30,000

The Y Drum cannot be utilized to soak and wash the salted raw skin as too much dirt and flesh is left on the raw skin. These would clog the perforated drum and drum dividers. Thus a paddle type processor would be required for the cleaning of the raw skin. This increased water usage is reflected in Table I. It is intended that the Hide Processor will be used in order to minimize the water utilization.

The level of contamination of the wastewater is highly dependent upon the type of skin purchased. Table II reflects this by showing higher contaminant concentrations for the salted raw skins.

TABLE II
WASTEWATER CHARACTERISTICS

CONTAMINANT	SALTED RAW SKIN	CRUST
Volume L/day	50,000	30,000
BOD mg/L	1,000	400
SS mg/L	1,000	500
Chromium mg/L	200	300
Chloride mg/L	11,000	8,000
Sodium mg/L	7,000	5,000
pH	3.5	4.0

The data in Table II is based on historical confidential information from RAL files, limited data collected in Europe from similar tanneries and our best technical judgements based on our knowledge of the tanning industry. Unfortunately we have not been able to locate a tannery who has utilized only this modern equipment. Usually they are old tanneries in the process of upgrading equipment and they have only replaced the most antiquated high water consumption equipment. Good records are available in water consumption, however, the net effect on the wastewater contaminant levels has not been monitored and is frequently overshadowed by the remaining old production equipment still in use in these older tanneries.

Table II represents our best estimate of the anticipated wastewater characteristics.

5 SOAK WATER REUSE

A major difficulty with on site disposal of wastewater with the characteristics shown in Table II is the presence of the high levels of sodium and chloride. Sodium has a negative affect on the soil tilth if applied at rates exceeding 400 Kg/ha/annum, and chloride is not alternated in the soil column and thus can contaminate the drinking water if diluted levels exceed 250 mg/L as chloride. Based on salt preserving techniques used in leather tanning industry approximately 20% of the incoming hide weight is salt as NaCl. If the same ratio is applied to sheepskin, the 500 skins at a gross weight of 5 Kg/skin will mean the introduction of 500 Kg of salt/day. The production process utilizes a further 400 Kg of salt/day. The values shown in Table II reflect these anticipated salt usage rates. It would seem to be practical to reclaim the salt from the preliminaary soak waters and reuse it for production purposes. Based on a majority of the salt being removed in the soak and first rinse the 500 Kg of salt will be contained in 6700 L of water making a concentration of 75 gm/L. This is well in excess of concentrations utilized in the production process.

In order to reuse this water it is imperative that the solids and dissolved organics be removed prior to reuse. An extensive review of the available technology finds that ultrafiltration is the only technique capable of removing the organics and allowing the salt to pass through the membrane. The residual grease in the wastewater may have to be removed prior to ultrafiltration in order to protect the expensive membranes from fouling.

The estimated capital cost for the ultrafiltration system with a capacity of 10,000 L/day would be $40,000 with an annual operating cost of $20,000. These costs are budget

estimates only and require confirmation by pilot testing prior to purchase of full scale equipment.

The water reclaimed by this internal recycle system will be stored in a 10,000 L brine tank and used as a concentrated salt source in all other areas and baths where salt is required in the formulation. It is estimated that this recycle will reduce the effluent chloride and sodium loadings by 50%. The reject waters containing the organics will be combined with the remaining wastewaters for subsequent on-site disposal. The savings associated with the operation will be 400 Kg of salt/day @ $100/Tonne, this represents a $40/day or $10,000/year savings in chemical costs. The savings would help offset the anticipated operating cost of the reclaim and recycle system.

6 POTENTIAL SALT RECOVERY

With the implementation of soak water salt recovery the plant water utilization will be reduced to 40,000 L/day when processing salted raw skins. The wastewater characteristics will be altered somewhat to reflect the reduced salt levels. Table III shows the anticipated contaminant concentrations.

TABLE III
WASTEWATER CHARACTERISTICS USING
SOAK WATER RECYCLE

CONTAMINANT	SALTED RAW SKIN	CRUST
Volume L/day	40,000	30,000
BOD mg/L	1,250	400
SS mg/L	1,250	500
Chromium mg/L	250	300
Chloride mg/L	7,500	8,000
Sodium mg/L	5,000	5,000
pH	3.5	4.0

Table III concentrations assume that the reject solids and BOD will be returned to the wastewater stream and combined with the other wastewater sources within the tannery.

In order to allow on site disposal of the wastewater the sodium and chloride concentrations must be reduced to those found in Table IV

TABLE IV
ALLOWABLE SODIUM AND CHLORIDE LOADINGS
FOR ON SITE DISPOSAL

CONTAMINANT	SALTED RAW SKIN	CRUST
Flow L/day	40,000	30,000
Choride mg/L	600	800
Sodium mg/L	400	535

By comparing Table III concentrations with those shown in Table IV it can be seen that approximately 90% of the sodium

and chloride must be removed from the wastewater in order to allow on-site disposal of the remaining wastewater.

6.1 Options Considered

In order to achieve a 90% reduction in sodium and chloride loading the following technologies have been investigated; Ion Exchange, Chemical precipitation, Ultrafiltration and Reverse Osmosis, and Evaporation. Combinations of these processes were also considered in attempting to reach the goal of 90% reduction. In addition to achieving the required removal efficiency, consideration must also be given to the handling of the concentrated material removed from the waste stream. In all cases the costs shown are budgetary estimates based on the currently available information and must be further refined by pilot testing to determine more exact equipment needs and operating costs.

6.2 Ion Exchange

The ion exchange process is best suited to the removal of a small amount of contaminant from a large volume waste stream. The concentrated waste streams encountered in this system will result in frequent recharge requirements. The end result will likely be that 50% of the water will be used to recharge and backwash the resin beds. This backwash water will require disposal and will not be suitable for on site disposal due to the high Sodium and Chloride loadings. Both Cation and Anion exchange systems would be required.

This technology could not achieve the desired results.

6.3 Chemical Precipitation

Both Sodium and Chloride are highly soluble in water. Very few compounds form insoluble precipitates with these ions. Those ions that do form precipitates are generally expensive and would require recovery from the sludge cake to make the system cost effective. The net affect would be to leave the Sodium and Chloride in two separate solutions both of which would be very difficult to handle in an environmentally safe manner. By combining the two solutions and a further evaporation step would leave you with a salt cake contaminated with the unreclaimed precipitant such as lead or silver. The nature and cost of the precipitants and the difficulty of handling the precipitated material result in anticipated operating costs of approximately $300,000 to $500,000 per year. Capital costs would be in the $300,000 to $400,000 range.

6.4 Ultrafiltration and Reverse Osmosis

These membrane separation techniques when used in series are able to produce a high quality effluent water with up to 90% removal of both Sodium and Chloride. The resultant "clean" water may be suitable for reuse in the tannery.

A system of single stage ultrafiltration to remove the organic components of the wastewater followed by two stage reverse osmosis to concentrate the ionic constituents such as Sodium, Chloride, Sulphates, Chromium, etc. into a 5% brine is technically feasible. The concentrated brine representing 20% of the wastewater volume could be subjected to evaporation techniques to provide a crystalline sludge for disposal or reuse.

Table V shows the anticipated costs for a membrane based system.

TABLE V
COSTS FOR MEMBRANE SYSTEMS

PROCESS	COSTS $ CAPITAL	OPERATING
Ultrafiltration	70,000	30,000
2 Stage Reverse Osmosis	90,000	50,000
Brine Evaporation	150,000	40,000
	310,000	120,000

Although these costs are high it is likely that the technology could be used to produce a satisfactory end result. Much of the reclaimed "clean" water could be reused in the tannery with the only loss in the system being by evaporation. If the "clean" water is not reused or only partially reused the remainder could be disposed of on site by the use of spray irrigation.

6.5 Evaporation

Evaporation by itself could be used to concentrate all the contaminants into a sludge cake for disposal.

Evaporation technology is well developed on large scale systems. At the size required by this site the equipment is almost considered to be pilot scale equipment. Energy consumption is of primary concern in the operating costs of an evaporation system. Single stage systems are high energy users with minimum capital costs. Multi Effect vacuum systems have a high capital costs but lower operating costs. Table VI summarizes the anticipated costs to handle 40,000 L/day of wastewater. It should be noted that multi effect

evaporators would require a pretreatment step of ultrafiltration to remove the organics which if left in place would badly foul the evaporator.

TABLE VI
COSTS FOR EVAPORATION
40,000 L/DAY

EQUIPMENT	CAPITAL	OPERATING
	$	$/year
1 Stage	500,000	300,000
Multistage plus Ultrafiltration	900,000	130,000

7 CHROMIUM RECOVERY

The techniques for Chromium recovery from tannery effluent are reasonably well documented. Chromium recovery is practised in both European and North American Tanneries.

Almost universally the wastewater pH is adjusted to 9.0± using a caustic agent such as Magnesium Oxide or Sodium Hydroxide. At this pH the Chromium is insolubalized and precipitates as Chromium Hydroxide. The precipitated Chromium can be removed from solution by settling under quiescent conditions frequently with the aid of a polymer to assist in clarifying the supernatant. In this particular case the daily wastewater volumes are small enough to allow all the wastewater to be subjected to Chromium removal in daily batch tanks. A total of three such tanks should be provided to allow one tank to be filling, one in the process of being treated and the third being decanted and the sludge removed for dewatering. The sludge can be readily dewatered in a plate and frame filter press and resolubalized to be reused for chrome tanning. The organic contaminants in the sludge cake may prove to be difficult to handle in the Chrome recycle system and may require special techniques to be developed, to ensure the Chrome solution quality is maintained. The organics tend to produce a char like material when the impure sludge cake is resolubalized using sulphuric acid at elevated temperatures. This char if not removed from the resultant solution will cause spotting on the tanned skin. Special corrosion resistant filtration equipment will be required to remove the char.

The probable value of the recycled chromium will be $6,000/yr. The cost of disposal of the sludge cake to a secure landfill will likely be $10,000/yr. The combined cost of sludge disposal and Chromium recovery may warrant the implementation of Chromium recycle.

The capital costs for Chromium recovery are $255,000 for salted raw skins and $190,000 for crust based production. The operating costs would in the $40,000/year range.

8 ON SITE DISPOSAL

In order to allow on site disposal as discussed earlier, it is imperative that the Sodium and Chloride levels be reduced to those values shown in Table IV. Chromium recovery is also required to reduce the Chromium level to 1.0 mg/L or less. This can be achieved by the proposed Chromium recovery system. The resultant wastewater will have the following characteristics:

TABLE VII
PRETREATED WASTEWATER CHARACTERISTICS
FOR ON SITE DISPOSAL

CONTAMINANT	SALTED RAW SKINS	CRUST
Flow L/day	40,000	30,000
BOD mg/L	600	200
SS mg/L	100	100
Chromium mg/L	1.0	1.0
Chloride mg/L	600	800
Sodium mg/L	400	535
pH	9.0	9.0

8.1 Soil Characteristics and Site Topography

The native soil in the area is a sandy loam underlain by up to 10 m of heavy clay mixed with stone. Although the topsoil layer (up to 0.6 m thick) likely has a relatively high permeability 3 x 10^{-3} cm/sec. the clay subsoil permeability is likely in the range of 3 x 10^{-5} cm/sec. The actual groundwater table is at an unknown depth. Each of these details will be confirmed by a more detailed hydrogeological study at latter stages of design.

A site plan is shown in Figure I. The arrows indicate the direction of slope on the land. The land slope is approximately 10% with a valley running north to south

on the property. Northward the land drains through a culvert under Highway 401 into an adjacent stream and ultimately to Lake Ontario. The usable area for spray irrigation when allowing buffer zones of 100 meters from any building is approximately 10 ha. out of a total site area of 15.5 ha. The closest residence to the site is approximately 285 m from the south-east corner of the property. In order to accommodate the proposed spray irrigation system it is proposed that the site evapotranspiration be maximized by utilizing Reed Canarygrass as the cover crop for the irrigation sites. This cover crop has high water usage, is excellent as a nitrogen user (200^{+} kg/ha) and tolerates prolonged soil saturation. The cover crop will be cut and baled as required to maintain active growth. The harvested material is of little use as a cattle feed due to its coarse nature and relatively poor feed value.

8.2 On site Storage

An on site lagoon will be constructed in order to store 200 days of wastewater production. the lagoon contents will be irrigated on adjacent land during the summer. In order to maintain the lagoon in an odour free aerobic condition mechanical aeration using an Aire-O_2 aerator will be considered. The total daily BOD applied is only 24 Kg/day. A single 5 HP aerator can handle 100 Kg BOD/day based on 2.5 lb O_2 supplied/HP hour under process conditions.

It is proposed that a single 5 HP aerator be supplied and spare parts be kept in stock as a backup system.

This lagoon will intersect the native clay subsoil which will also be used for construction of the berms.

The low clay soil permeability of 3 x 10^{-5} cm/sec will ensure that the lagoon contents do not contaminate the local groundwater. Groundwater monitoring wells will be installed upstream and downstream of the lgaoon and monitored biannually to ensure no groundwater contamination takes place.

8.3 Irrigation System Design

In order to determine the hydraulic capacity of the land and crop to dissipate water the following equation was used:

$$Lw = ET - Pr + Pw$$

where Lw = wastewater hydraulic loading rate cm/month
Et = evapotranspiration rate cm/month
Pr = precipitation rate cm/month
Pw = percolation rate cm/month

The monthly values for evapotranspiration and precipitation are from Environment Canada "The Climate of Southern Ontario" by Brown, McKay and Chapman.

The percolation rate was calculated using 10% of the percolation rate of the most restrictive soil layer. In this case we have utilized 10% of the subsurface infiltration rate or 3 x 10^{-6} cm/sec.

TABLE VIII-WATER BALANCE TO DETERMINE HYDRAULIC LOADING RATES
cm/MONTH

MONTH	ET Evapo-transpiration	Pr Precipi-tation	Pw Perco-lation	Lw Hydraulic Loading
April	6.5	8.0	7.8	6.3
May	9.7	7.3	8.0	10.4
June	11.5	7.6	7.8	11.7
July	13.2	7.9	8.0	13.3
Aug	11.9	7.8	8.0	12.1
Sept	7.8	6.5	7.8	9.1
Oct	4.2	5.7	8.0	6.5
Annual Total				64.8

It should be noted that the values for Evapotranspiration used in Table VIII are likely lower than those that would be experienced on irrigated fields adjacent to dryer unirrigated fields.

In total there are 10.0×10^3 m^3 of wastewater to be disposed of annually. Based on an annual hydraulic application rate of 64.8 cm/annum, 1.5 hectares of land are required. In total 10 hectares of land are available for irrigation purposes. The excess land available will allow for periods of abnormally high rainfall or resting of a portion of the land.

The annual hydraulic application rate is established in part by the percolation rate of the most restrictive soil layer. The daily application rate and the cycle of application are determined by the surface or Topsoil characteristics. In this case the top 0.6 m has an infiltration rate of 3×10^{-3} cm/sec. If we use 7% of this capacity water can be applied at a rate of 0.7 cm/hr for 2.5 hours without causing ponding. The applied water can be stored in the topsoil layer and used by the crop or percolated through the subsoil. Wastewater should be applied once per week in late April, May, September and early October. During the months of June, July and August wastewater can be applied twice per

week. This allows for 38 applications per disposal season and accounts for 66.5 cm of wastewater applied. In practice only 10 cm of wastewater will be applied to the full 10 hectares available for irrigation. This allows more than adequate reserve capacity to accommodate years with abnormally high rainfall. The equipment to be utilized to apply the wastewater on the irrigation sites is as follows:

- gas driven pump, 80 psig at the pump discharge
- farm style irrigation pipe - 100 mm diameter
- two large irrigation guns using a 30.5 mm diameter orifice (manufactured by Nelson & Rainbird)

The spray diameter of the large irrigation gun is 104 m. The output rate at 80 psi is 988 L/min giving an applied load of 0.7 cm/hr.

The sodium loading rate based on an annual output of 4,000 Kg of Na/yr. is 400 Kg/yr/ha. This is the maximum rate suggested by the University of Guelph, Appendix C.

The capital costs of the lagoon and spray irrigation system are $60,000.00 with an estimated annual operating cost of $5,000.00.

9 CONCLUSIONS & RECOMMENDATIONS

9.1 From an environmental perspective, it is technically feasible to establish the proposed tannery on the Hope Township site.

9.2 The most cost effective system would be to recycle soak water using ultrafiltration, treat the total wastewater with ultrafiltration, reverse osmosis and evaporation. Recycle of the clean water should be the ultimate objective. If this cannot be achieved in total, a small amount of the clean water can be treated for residual chromium removal, lagooned and spray irrigated.

9.3 Detailed studies need to be undertaken in the following areas to confirm the design loadings and assumptions made in this feasibility study:

- Ultrafiltration of soak water
- Ultrlafiltration and reverse osmosis of total effluent water
- Evaporation of reverse osmosis reject water
- Site hydrogeology for water supply and spray irrigation (if required)

APPENDIX A

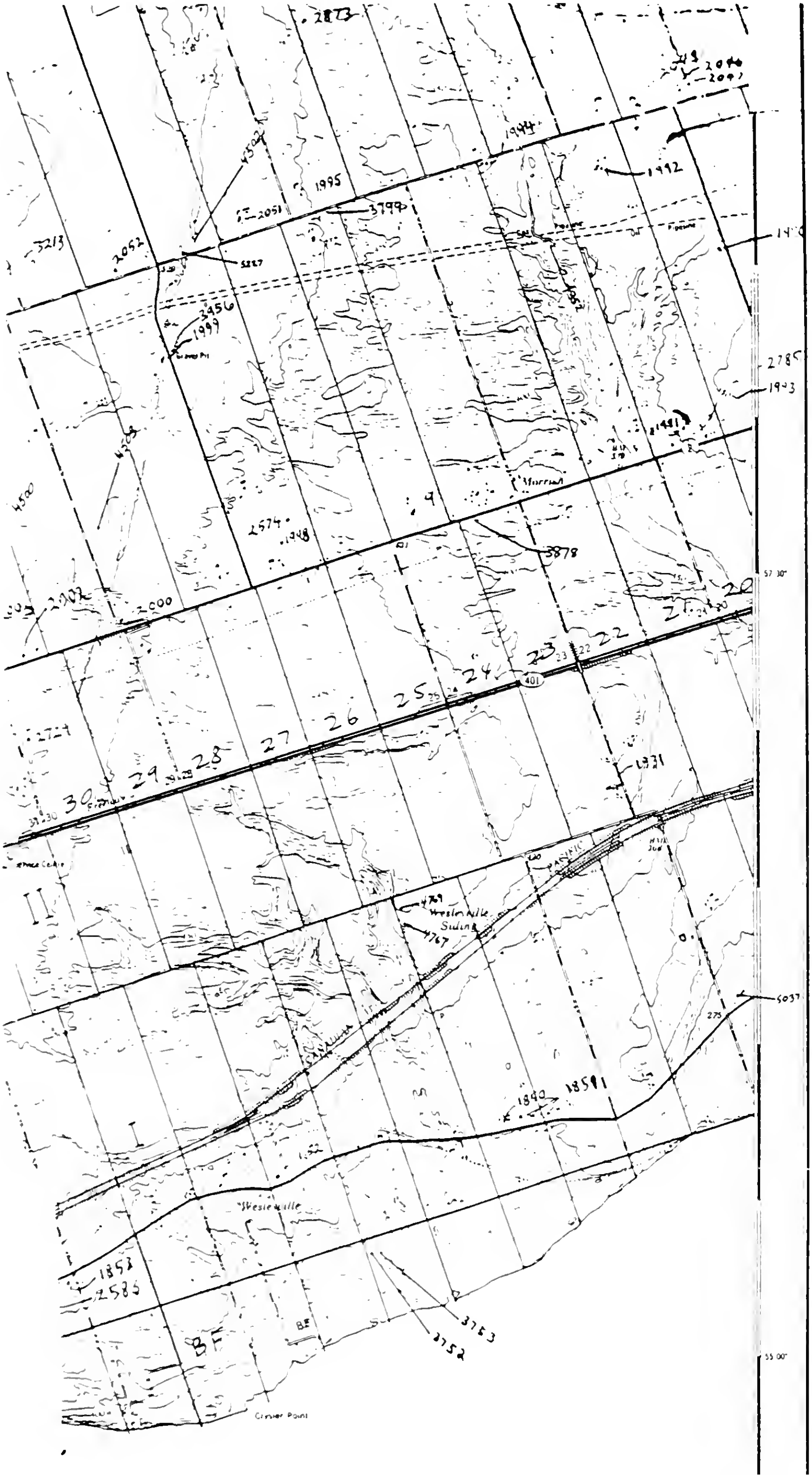
WELL WATER RECORDS

MUNICIPALITY CONCESSION ETC	LOT	WELL NO	UTM EASTING NORTHING	ELEV FEET	DATE	DRILLER	CSG DIA INS	KIND OF WATER	WATER FOUND FEET	STAT LVL FEET	PUMP LVL FEET	TEST RATE GPM	TEST TIME HR/MN	WATER USE	OWNER/LOG/SCREEN DEPTHS IN FEET TO WHICH FORMATIONS EXTEND
HOPE TOWNSHIP (CONTINUED....)															
			4505 4868219												BRWN SAND 0005 BRWN CLAY GRVL 0030 BLUE CLAY SAND 0100 BLUE GRVL 0105 GREY LMSN 0109
CON	1	17	19- 712400 1845 4869725	315	04/56	4829	6	FR	99	40	50	10	1/00	ST	HASKILL H CLAY 0040 GSND 0080 BLUE CLAY 0099 MSND 0100
CON	1	18	19- 712330 3217 4868460	365	07/71	4713	6	FR	67	18	50	25	2/30	ST DO	TALLO STEVE BRWN CLAY STNS 0053 BRWN MSND 0067 (S 0059 08)
CON	1	18	19- 712550 1846 4868290	340	10/59	2113	6	FR	111	50	103	4	3/00	PS	PORT BRITAIN SCHOOL TPSL 0001 BRWN CLAY MSND 0015 FSND 0070 GREY CLAY MSND 0110 GRVL 0111
CON	1	21	45- 710940 4758 4868060	286	06/76	1904	6	SU	45	12	35	15	2/00	DO	SCULTHORPE ROBERT TPSL DKCL 0002 BRWN CLAY SAND 0004 GREY CLAY 0040 GREY LMSN 0046
CON	1	21	45- 711200 4757 4867920	260	05/76	1904	6	FR	28	10	28	30	4/00	DO	SCULTHORPE ALICE TPSL DKCL 0001 BRWN CLAY GRVL 0015 GREY CLAY GRVL 0028 GRVL CLAY 0029 GREY LMSN 0040
CON	1	21	19- 711200 1848 4868250	250	09/56	2501	6	SU	92	8	8	10	72/00	DO	SCULTHORPE B JR TPSL 0004 CLAY 0024 GREY LMSN 0092
CON	1	21	19- 711250 1847 4868040	250	08/55	2501	5	FR	50	27	27	9	/10		SCULTHORPE B PRDG 0019 SHLE 0050
CON	1	21	19- 711300 1849 4868050	250	06/58	5422	6	FR FR	28 182	12	40	30	12/00	DO	SCULLTHORDE ROBERT BLCK TPSL 0002 BLUE CLAY BLDR 0028 LMSN 0186
CON	1	22	45- 710600 5037 4867880	280	08/78	4867	36	FR FR	7 16	1	9			DO	REEVE FLORANCE BRWN CLAY STNS HARD 0007 BRWN CLAY SNDY WBRG 0008 BLUE CLAY STNS HARD 0016 GREY GRVL STNY SOFT 0017
CON	1	22	19- 710856 3915 4867861	264	07/74	5207	36	FR	16	3	17	6	3/00	DO	HALL G H BLCK TPSL CLAY 0001 BRWN CLAY 0008 BLUE CLAY 0016 BRWN GRVL CLAY STNS 0018
CON	1	26	45- 708600 4769 4868340	452	08/77	2104	6	FR	23	23	40	1	4/00	DO	SCOUTS CANADA PT H BRWN SAND SOFT 0023 (S 0022 03) GREY CLAY 0045
CON	1	26	45- 708620 4767 4868260	436	08/77	2104	6		DRY						SCOUTS CANADA PT H BRWN SAND 0060 GREY CLAY GRVL 0180 GREY LMSN HARD 0385
CON	1	26	19- 709150 1850 4867150	325	10/61	2113	6	FR	89	35	85	5	3/00	DO	AUSTIN A TPSL 0001 BRWN CLAY MSND 0015 GREY CLAY 0089 SHLE 0091
CON	1	30	19- 707700 1851 4866750	325	10/61	2113	6	FR	40	3	37	3	3/00	DO	EMENO F F TPSL 0001 BRWN MSND CLAY 0015 GREY CLAY 0025 BRWN FSND STNS 0040 GRVL 0041
CON	1	31	19- 707350 1852 4866650	325	10/53	4713	6	FR	40	FLW				PS	HESLEYVILLE SCHOOL TPSL 0002 BLUE CLAY 0039 GRVL MSND 0040

NORTHUMBERLAND COUNTY 45

MUNICIPALITY CONCESSION ETC	LOT	WELL NO	UTM EASTING NORTHING	ELEV FEET	DATE	DRILLER	CSG DIA INS	KIND OF WATER	WATER FOUND FEET	STAT LVL FEET	PUMP LVL FEET	TEST RATE GPM	TEST TIME HR/MN	WATER USE	OWNER/LOG/SCREEN DEPTHS IN FEET TO WHICH FORMATIONS EXTEND
HOPE TOWNSHIP (CONTINUED....)															
CON	2 13	19- 1930	713320 4871945	430	12/67	3102	30	FR FR	12 25	13		3		DO	KOSMALYA JOHN TPSL 0001 BRWN CLAY 0008 FSND 0012 GRVL 0015 BLUE CLAY MSND 0025 FSND 0030
CON	2 13	19- 1926	713356 4871860	430	10/57	5422	7	FR	121	8	40	7	2/00	DO	WADDELL M TPSL 0004 BLUE CLAY 0090 BLDR 0098 GREY LMSN 0122
CON	2 13	19- 3092	713600 4870210	465	05/71	3129	30	FR	10	10	26	8	1/00	DO	INWARDS J GREY CLAY 0015 BLUE CLAY 0027
CON	2 13	19- 2972	713630 4870250	460	10/70	2501	6	FR	110	70	109	1	1/00		BIENIAS MARIO YLLW MSND 0015 GREY CLAY 0111
CON	2 13	19- 1928	713799 4870321	475	10/65	2104	6	FR	45	2	46	2	9/00	DO	LACEY FRED PRDG 0011 GREY CLAY STNS 0030 GREY CLAY STNS 0046 GRVL CLAY 0051
CON	2 13	45- 6537	713800 4870180	470	11/81	3136	6	FR	181	70	120	20	6/00	DO	WELLS J BRWN TPSL 0001 BRWN CLAY STNS 0027 GREY CLAY STNS 0085 GREY CLAY SNDY 0089 GREY CLAY STNS 0179 GREY LMSN LYRD 0185
CON	2 13	45- 4507	713946 4870264	495	10/75	2104	6	FR	210	85	224	3	1/00	DO	MCDONALD DAVID GREY CLAY STNS 0040 BLUE CLAY SAND 0210 GREY LMSN 0224
CON	2 15	19- 4186	712420 4871880	414	08/75	2118	6	FR	21	8	14	10	1/00	DO	BELL CANADA BRWN SAND 0020 BRWN GRVL SAND 0021
CON	2 16	45- 5571	711840 4871660	380	09/80	1572	6	FR	78	30	70	5	2/00	DO	CLANCY M BRWN TPSL SOFT 0003 GREY CLAY GRVL HARD 0075 GREY SAND GRVL HARD 0078
CON	2 23	19- 3878	709004 4870571	410	01/74	2104	6	FR	73	21	40	10	3/00	DO	OSBORNE A PRDG 0025 GREY CLAY GRVL 0073 BRWN GRVL SAND 0074
CON	2 23	19- 1931	709850 4869150	425	08/60	4713	6	FR	200	30	190	5	2/00	DO	ANDERSON NEIL TPSL 0002 CLAY STNS 0178 LMSN 0200
CON	2 24	19- 1932	708550 4870525	425	11/48	2116	4	FR	60	20	40	5	2/00	PS	SCHOOL SECTION SHOPE TPSL 0003 CLAY MSND STNS 0060 GRVL 0064
CON	2 28	19- 1935	707525 4869050	455	08/62	2518		SU	230						DEPT OF HIGHWAYS TPSL 0003 FSND 0018 QSND 0120 BLUE CLAY 0224 LMSN 0232
CON	2 28	19- 1933	707750 4868575	450	08/62	2518	6		DRY						DEPT OF HIGHWAYS TPSL 0003 GRVL 0039 CLAY GRVL 0070 QSND 0073
CON	2 28	19- 1934	707800 4868525	450	08/62	2518			DRY						DEPT OF HIGHWAYS TPSL 0003 CLAY GRVL 0051 BRWN CLAY STNS 0070 QSND 0071
CON	2 29	19- 1936	706995 4868825	475	07/62	2518	8		DRY						DEPT OF HIGHWAYS GRVL 0012 FSND 0075 QSND 0122
CON	2 29	19- 1937	707125 4868900	470	08/62	2518	6		DRY						DEPT OF HIGHWAYS TPSL 0003 MSND 0045 QSND 0130 BRWN CLAY MSND 0250 QSND 0251 LMSN 0252
CON	2 30	19-	706420	560	04/69	2104	6	FR	249	63	74	10	3/30	ST DO	RABY CHAS

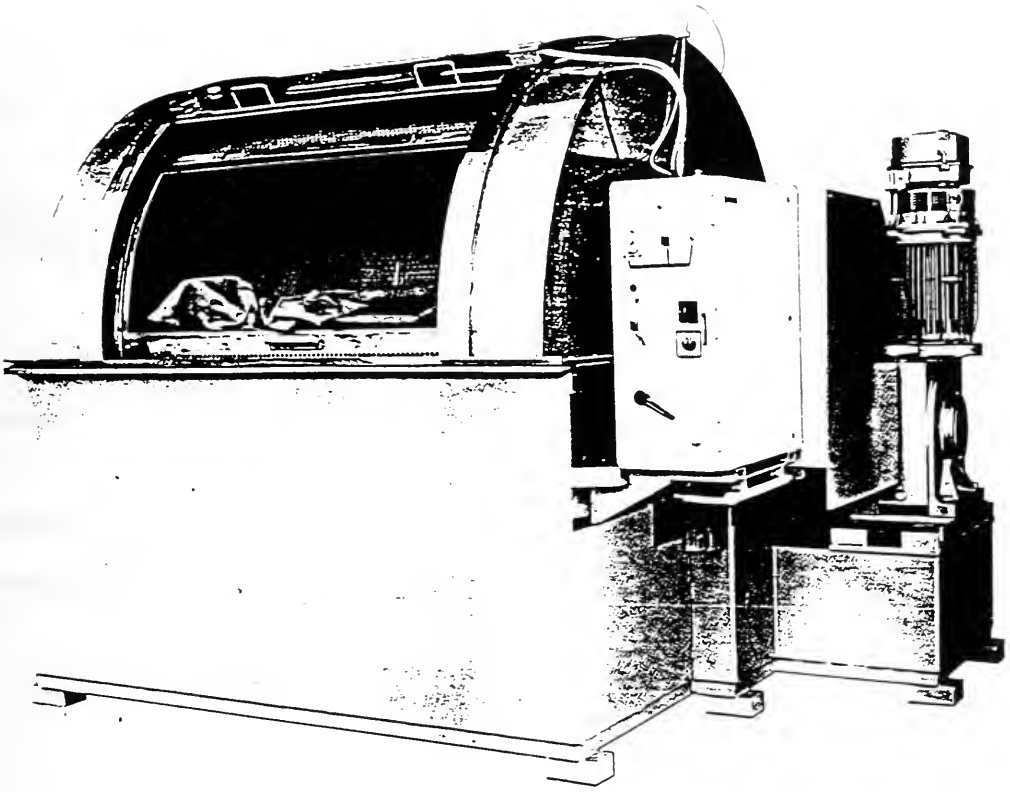
- CONTINUED -


2873
2046
2047
1994
4502
1992
1995
2051
3799
Pipeline
3213
2052
5227
3456
1999
Gravel Pit
2785
1943
1481
4203
Morrish
4500
2574
1948
3878
57 30'
2002
2000
20
21
22
23
24
401
25
26
27
28
29
30
2724
1331
PACIFIC
4767
Weslemkille Siding
II
5037
275
1840
1859
I
Wesleville
1853
2585
3753
3752
BF
55 00'
Crysler Point

2380

	CON	3	21	19- 4352	709380 4872280	380	04/76	2104	6	FR	56	22	55	10	3/00	DO	BROWN H M BLCK TPSL SOFT 0002 BRWN CLAY PCKD 0018 GREY GRVL CLAY DNSE 0019 GREY CLAY STNS LOOS 0056 GREY LMSN PORS HARD 0063
	CON	3	22	19- 3549	708620 4872520	440	03/73	2104	6	FR	59	8	10	40	2/30	DO	PETERSEN R O TPSL 0002 BRWN CLAY SAND 0012 GREY CLAY SAND 0059 BRWN GRVL CSND 0061
	CON	3	22	19- 1995	708990 4872800	450	12/59	4713	6	FR	63	20	55	5	2/00	PS	BUNKER HILL SCHOOL TPSL 0002 CLAY STNS 0018 BLUE CLAY 0062 GRVL MSND 0063
	CON	3	23	19- 1996	708800 4870750	400	04/63	5412	30	FR	32	25		2		DO	CLARKE SAM BRWN CLAY 0002 BRWN CLAY MSND 0004 BRWN CLAY 0008 BLUE CLAY 0020 BLUE CLAY STNS 0032 CSND 0035
	CON	3	23	19- 2693	709000 4870830	405	02/69	3102	30	FR	31	12				ST DO	OSBORNE HAROLD TPSL 0003 CLAY 0038
	CON	3	23	19- 1997	709050 4870850	410	03/65	2306	6	FR	65	60	82	2	10/00	DO	OSBORNE HAROLD TPSL GRVL 0040 MSND GRVL 0060 CSND FSND 0102 (S 0096 06)
	CON	3	24	19- 2692	707950 4872070	500	07/68	3102	30	FR	15	4				ST	MILLSON LLOYD TPSL 0002 MSND 0010 CLAY STNS 0025
	CON	3	24	19- 3799	708070 4872356	490	10/73	2214	6	FR	166	50	50	10	2/00	DO	MILLSON D BRWN CLAY STNS 0100 BLUE CLAY 0142 LMSN 0166
	CON	3	24	19- 3192	708650 4870780	425	11/71	3129	30	FR	20	20	34	8	1/00	ST	YOUNG F TPSL 0001 MSND 0010 BLUE CLAY 0030 BLUE CLAY GRVL 0035
	CON	3	26	19- 3956	707169 4871513	540	09/74	2214	30	FR	8	6	14	6	1/00	DO	MILLSON R BLCK TPSL 0001 BRWN CLAY STNS 0008 GREY CLAY SILT 0015
	CON	3	26	19- 1998	707800 4870500	480	11/66	5412	30	FR	12	12		2		DO	BEEBE D TPSL 0001 BRWN CLAY MSND 0012 BRWN CLAY GRVL 0022
	CON	3	26	19- 2574	707900 4870600	480	10/68	2306	6	FR	169	20	60	5	3/00	DO	BEEBE DAWSON PRDG 0020 CLAY STNS 0165 GREY SHLE 0169
	CON	3	27	19- 1999	707100 4871400	525	08/67	3102	30	FR	5	5		2		DO	HARNESS SAM TPSL 0001 FSND 0016
	CON	3	28	45- 4503	706740 4870540	580	10/74	4713	6	FR	250	90	220	12	2/00	DO	DUNNE EDWARD P BRWN CLAY STNS 0040 BRWN CLAY SAND 0065 BLUE CLAY 0256 BRWN GRVL SHLE 0258
	CON	3	28	19- 2000	706900 4870050	525	09/63	5412	30	FR	10	10		5		DO	HARNESS CALVIN YLLW MSND 0008 MSND STNS 0010 MSND 0020
	CON	3	30	19- 2001	705800 4870450	600	11/58	2306	6	FR	297	39	100	8	2/00	PS	ROMANCATHOLIC SCHOOL PRDG 0035 MSND 0135 CLAY 0295 GRVL 0297
	CON	3	30	45- 4500	706040 4869900	605	05/75	3129	30	FR	40	38	52	14	1/00	DO	RICH-KOR DEVELOPMENT TPSL 0001 HPAN STNS 0030 GREY CLAY 0041 CSND 0055
	CON	3	30	19- 3974	706091 4869699	608	08/74	3129	30	FR	49	45	64	14	1/00	DO	RICH-WAY DEVELOP-CO. TPSL 0001 GREY CLAY 0020 HPAN STNS 0052 GRVL 0059 CSND GRVL 0065
	CON	3	30	19- 3975	706126 4869622	610	08/74	3129	30	FR	46	44	63	12	1/00	DO	RICH-WAY DEVELOP TPSL 0001 GREY CLAY 0020 HPAN STNS 0048 GRVL 0057 CSND 0065
	CON	3	30	19- 2003	706200 4869800	600	11/66	5412	30	FR	40	41		2		DO	TITTERINGTON RAY TPSL 0002 FSND 0040 CSND 0048
	CON	3	30	19- 2002	706300 4869850	590	06/65	5412	30	FR	30	12		5		DO	HOCKINS KEN TPSL 0001 BRWN CLAY MSND 0012 FSND 0030 CSND 0035 FSND 0042

APPENDIX B - 1



PERFORATED STAINLESS STEEL THREE COMPARTMENT AUTOMATIC MACHINE FOR TREATMENT AND DYEING OF SKINS AND FURS

With our " TANNOX " drum it is possible to process and dye all types of skins and furs, and comply with the current requirements demands of tanneries, leather dressers and furriers, with chemical formula compatible with used stainless steel.

THE CONCEPTION OF WORKING :

– The " TANNOX " accomodates both in volume and weight, double the amount of skins of a conventional drum of the same capacity. This is due to the availability of the complete volume of the drum, whereas in a standard drum only the lower half may be used.

– The time of the operations is reduced considerably (30 to 50 %).

– With a reduction in volume of the bath a significant economy of chemicals can be achieved (5 to 30 %).

– Easy introduction of the chemicals with an instantaneous distribution without stopping the machine.

– Automatic maintenance of exact temperature.

– Constant control of the processes: visually through porthole, taking of samples, combined temperature with thermostat, maintaining level of float.

– Emptying and washing off, without stopping the machine with the possibility of draining the skins before unloading.

– The reversing of rotations reduces the risk of tieing up the skins.

– The reduction of the float and its complete drainage produce considerable reduction of effluent.

– Easy cleaning of the machine between the different operations.

TECHNICAL CHARACTERISTICS :

– Simple installation (monobloc - construction).

– For the same capacity with a conventional drum there is a space saving of about 50 %.

– Easy utilisation all controls on centralised panel, with an adjustable timer for each operation and monitored by illuminated press buttons.

– Better cleanliness of the working areas.

– Simple and inexpensive maintenance.

– Chemical formula compatible with used stainless steel.

DESCRIPTION :

1° – One half-cylindrical tank, with outlet for the complete drainage, fabricated entirely in stainless steel (norm AFNOR Z8 CNDT 17-12, Z2 CND 17-13 or similar).

2° – One interior drum divided into three semgented compartments each equivalent to 120° of the whole. Constructed from perforated stainless steel.

3° – A half-cylindrical exterior upper cover of stainless steel, consisting of a sliding door fitted with a transparent porthole in LEXAN material:
. Magnetic locking security system
. Services inlet point at the rear for water and chemical produces.

4° – An interior sheathing in mild steel of the inside cylindrical tank with a sandwich layer between, of an impermeable material with good insulation qualities.

5° – One surround support of heavy gauge mild sheet steel with two coats of anticorrosive paint.

6° – A motor gearbox assembly with transmission by Poly V belts.

7° – A control panel in anticorrosive plastic, grouping all the controls.

8° – An automatic system to stop the compartments in the unloading or loading position by motor brake.

OPTIONAL EQUIPMENT :

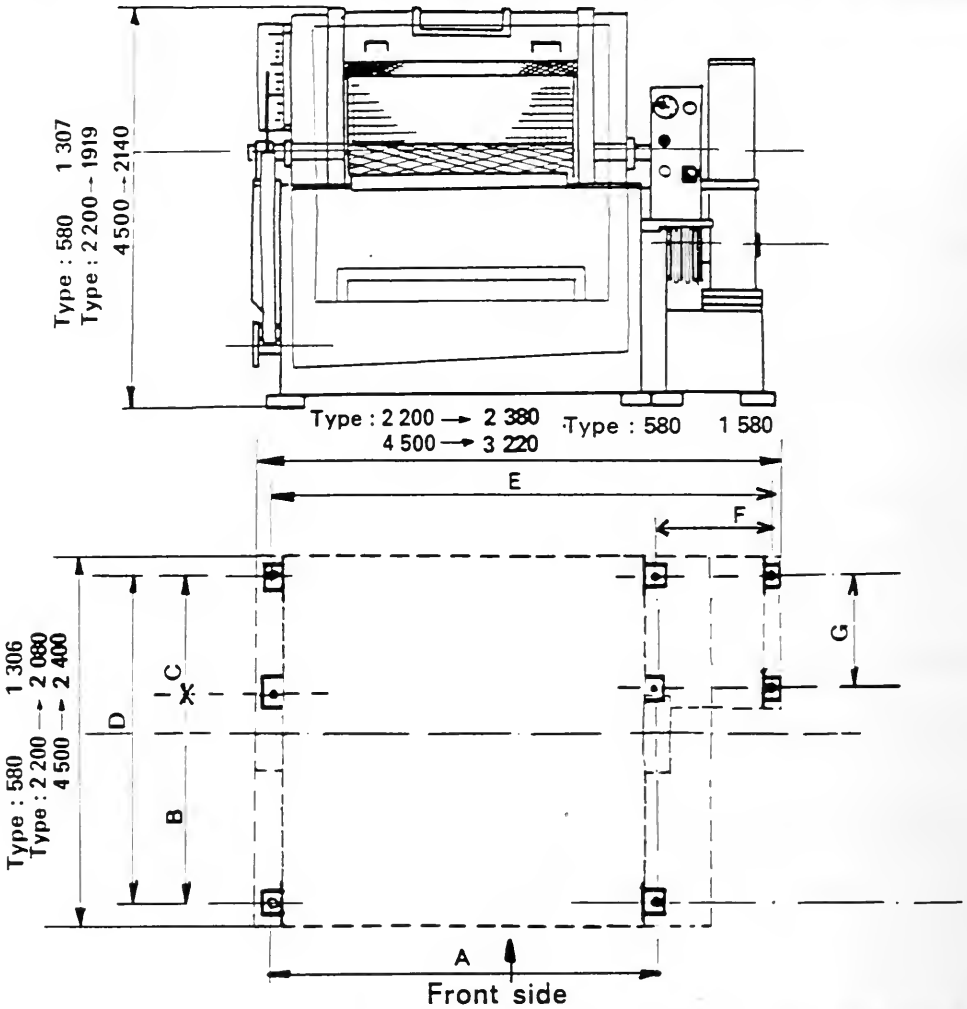
a) Our " TANNOX " can be delivered in different versions :
. 1 speed = Type A
. 2 speeds = Type B

b) We can supply the valves for the filling and the emptying of the vessel by :
. manuel
. electromagnetic
. electropneumatic.

CHARACTERISTICS

TYPE	Utilisable Volume	Speed	Motor H.P.	Heating	Weight Kgs	Possibilities according to weight-volume ratio	
						Dryed wet blue	Fleece sheepskins
580 V	580 L.	Variable	1.5	2 KW	800	75 to 120 kgs	35 to 45
2.200 A	2.200 L.	1	7,5	4 KW	1.900	300 to 500 Kgs	170 to 200
2.200 B	2.200 L.	2	7,5-5,5	4 KW	1.900	300 to 500 Kgs	170 to 200
4.500 A	4.500 L.	1	12	8 KW	3.200	600 to 1000 Kgs	350 to 400
4.500 B	4.500 L.	2	12-8,5	8 KW	3.200	600 to 1000 Kgs	350 to 400

INSTALLATION PLAN



Type	2200	4500	580
A	1605	2207	990
B		1243	
C		664	
D	1644	1907	1 100
E	2103	2882	
F	498	675	
G	671,3	860	
Hole nb.	6 × Ø 20	6 X Ø 20 2 × Ø 26	4 × Ø 12

Right of modificatio
reserved without
communicating it.

THE TANNOX JUNIOR

SIC 87 !

- TANNOX JUNIOR exhibited model with a useful capacity of 2200 liters, able to treat 500 kilos of wet-blue or 1000 kilos of pelts without pair.

For every operation in wet : tanning, pickling, but recommended for operations of soaking, retanning, fatliquoring, dyeing.

* MACHINE WHOLLY BUILT in STAINLESS STEEL 316L or 316TI to use with chemical formula compatible with used stainless steel.

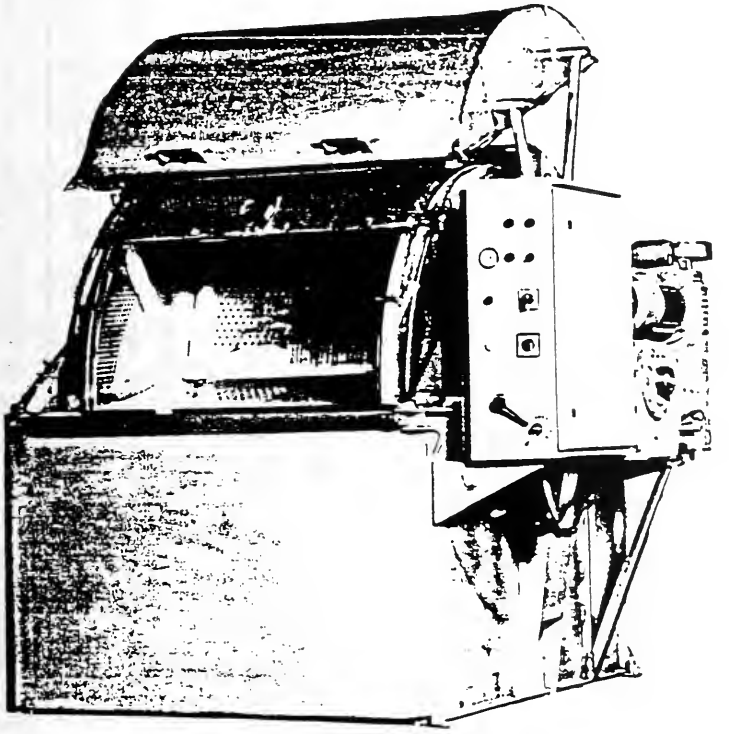
* With a perforated three compartments drum rotating in a vat where the baths are.

with : a) a speed variator (speed selector by remote control letting know the speed) which allows to choose speeds from 4 to 20 rev. per minute.

b) temperature regulation incorporated, allowing heating and maintenance of baths with steam heating or only maintenance of temperature with electric heating.

c) opening and closing of outside vat entirely manual, but assisted sealing by rubber joint, easily interchangeable and which allows a complete opening of the vat, i.e. cleaning of the drum easier.

d) other equipment identical to TANNOX standard, emptying, checking of level, sampling, trap to introduce powders with transparent checking window, working in alternated running, alternation time modifiable, or in continuous reverse, possibility of programming.



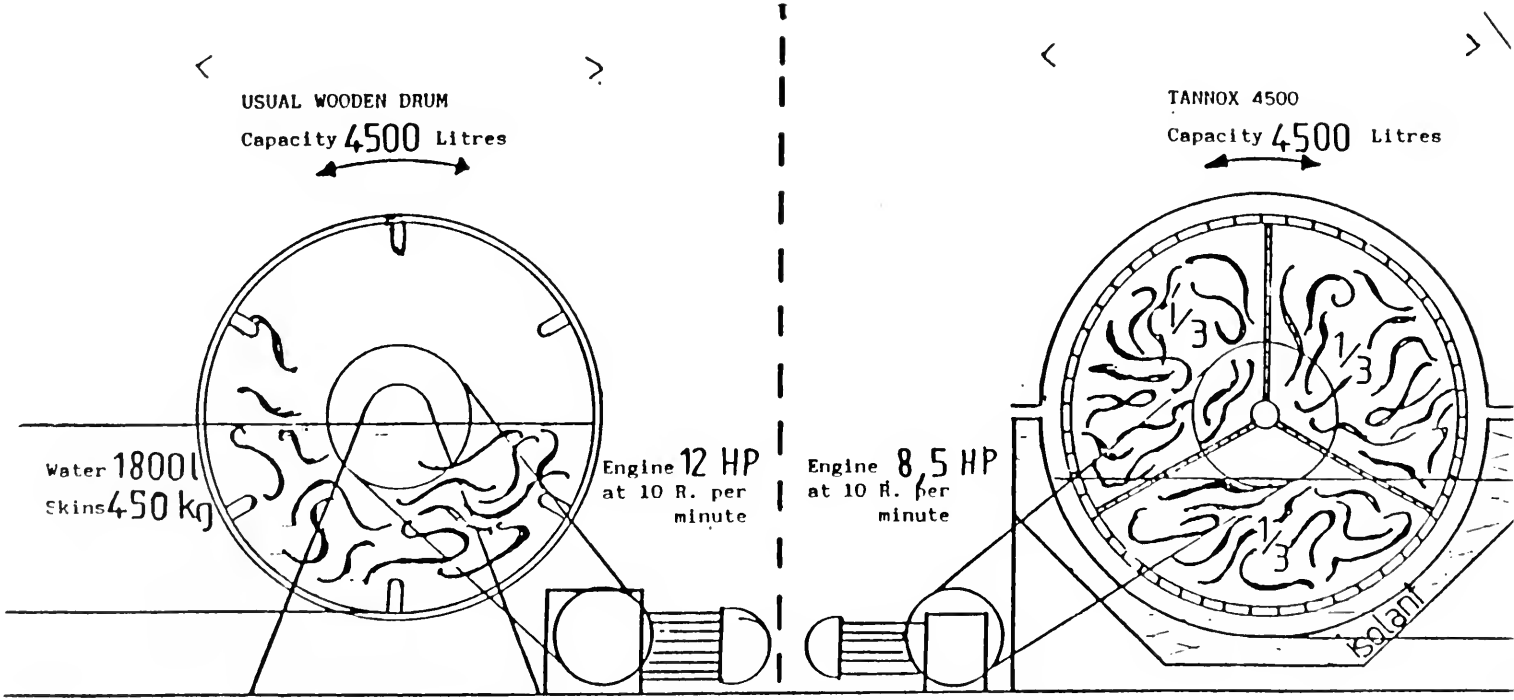
We recommend to use the **TANNOX JUNIOR** (exhibited), non-isolated, with a maximum temperature of 30°C in temperated countries, or 40°C in warm countries. For higher temperatures, see **TANNOX** standard.

EVERY OPTION POSSIBLE.

WEIGHT : 1300/1400 KILOS
Bulk :
Without trap :
2140 X 1900 X 1940 M/M
With trap :
2140 X 2100 X 1940 M/M

MONOBLOC MACHINE with lifting hooks, ready for use with instructions for connecting, working and maintenance (no installation expenses).

SOCIETE R.I.A.T. CHIRENS
38850 CHARAVINES FRANCE
TEL. 76.35.20.34
TELEX 320544 F



This drawing compares a usual wooden drum with
a 3 COMPARTMENTS DOUBLE TANK TANNOX Machine
and shows how you can save WATER and ENERGY, for an OPERATION with a 400% BATH
(This information is given for your guidance without envolving our responsability)

Electrical Consuption	$\frac{12 \text{ HP} \times 736 \text{ W} \times 7 \text{ h}}{4{,}5 \text{ Kg}} - 0{,}137$ KW/h for 1 Kg of Skins	$\frac{8{,}5 \text{ HP} \times 736 \text{ W} \times 4 \text{ h}}{9 \text{ Kg}} - 0{,}027$ KW/h for 1 Kg of Skins
Time	7h 3 opérations a day (7 x 3) = 21 hours	4h 5 operations a day (4 x 5) = 20 hours
Water	$\frac{1800 \text{ l}}{450 \text{ Kg}} - 4 \text{l}$ for 1 Kg of drained Wet-Blue Skins	$\frac{1350 \text{ l}}{900 \text{ Kg}} - 1{,}5 \text{l}$ for 1 kg of drained Wet-Blue Skins
Calories	$((20° - 70°) \times 1800 \text{ l} - \frac{90.000 \text{ cal}}{450 \text{ Kg}} - 200$ cal for 1 Kg of Skins	$(20° - 70°) \times 1350 \text{ l} - \frac{67.500 \text{ cal}}{900 \text{ Kg}} - 75$ cal for 1 kg of Skins

Comparison about current operations of
soaking retannage neutralisation fatting dyeing rinsing draining
starting from weights of drained Wet-Blue skins

USUAL WOODEN DRUM CAPACITY 4500 Litres TANNOX Model 4500

- OUTPUT PER DAY (24 h) Ratio 4500 : 1350 = 3,33

  450 Kg x 3 = 1350 Kg | 900 Kg x 5 = 4500 Kg

- CHEMICALS - Savings (because of the reduction of the baths) from 5 to 30% depending on operations and formulas

- REGULARITY OF PENETRATION AND TREATMENT -

  For 500 rotations of the drum, the skins may dip :

  150 ? 200 ? 300 ? 400 ? Times

  For 500 rotations of the drum, the skins dip regularly and obligatorily :

  500 Times

- REGULARITY FOR RENEWING AN OPERATION -

A- Quantity of baths : Cannot be checked	Permanent measurement and checking
B- Quantity of chemicals : Depending on formula	depending on formula
C- Temperature : Cannot be checked or choosen	Permanent checking and automatic regulation
D- Quantity of skins : Depending on operation	Depending on operation
E- Time for each operation : Cannot be checked	Checked and choosen
F- Checking of PH : The machine must stop	Without stopping the machine

- SALVAGING OF BATHS -

  Very difficult and even impossible for the totality of baths

  Without any problem and the whole bath can be recycled

THER ADVANTAGES :

- EASY AND CHEAP INSTALLATION and starting up by users themselves
- FLOOR AREA COVERED, for the same production, 3 times less than a usual wooden drum
- EASY USE by usual users of drums
- POLLUTION : less refuse, baths are better used and purified because the skins act as a filter in front of the holes of the drum
- POSSIBILITY OF DRAINING the skins before unloading
- LESS DAMAGED SKINS (because there are no wedges inside the drum)
- CONDITIONS OF WORK :
  - A- Safer, no moving part outside the tank
  - B- If installed properly, no water round the machine
  - C- Easy loading and unloading of skins (which are already drained)
  - D- Rather noiseless work.

ANDBACKS

A1

MILLAU

ETUDE COMPARATIVE

CHEVRES, CHEVREAUX : retannage, teinture, nourriture

1000 kg dérayé

		FOULON 3 x 1,70	TANNOX 4 500
Retannage			
Eau 40°C	100%	1 000 L	600 L
Neutrigan 94	1%	10 kg	7 kg
Rotation		30' mise	20'
Relugan RE	3%	30 kg	30 kg
Rotation		30'	15'
Basyntan AN	6%	60 kg	50 kg
Mimosa	4%	40 kg	35 kg
Rotation		1 H	45'
Neutrigan P4	1%	10 kg	10 kg
Bic	0,5%	5 kg	5 kg
Rotation		60'	45'
Rinçage 40°/50°		4 000 L	2 000 L
Rotation		30'	5'
Teinture / nourriture			
Eau 50°C	100%	1 000 L	600 L
Amollan R	1%	10 kg	7 kg
Rotation		5'	5'
Colorant	3,3%	33 kg	20 kg
Rotation		60'	30'
Lipoderm LC	4%	40 kg	35 kg
Lipoderm SC	1%	10 kg	10 kg
Huile lipo SK	0,5%	5 kg	5 kg
Rotation		45'	30'
Acide formique 85%	2%	20 kg	20 kg
Rotation		60'	45'
Rinçage 20°C		4 000 L	2 000 L
Rotation		30'	5'
Chevalet			
Mise au vent			
Vide			
Suspension			
Humeur			
Palisson			
Cadrage			
Finissage			
Eau		10 000 L	5 200 L
Temps		6 H 30	4 H
Produits chimiques		273 kg	234 kg
		- 48%	
		- 38%	
		- 14%	

de réduction

CHEVRE, CHEVREAUX (Suite)

	Drum FOULON 3 x 1,70	TANNOX 4500
Puissance	25 HP x 0,736 x 6,5 H x 0,502F = 60,00 Frs	12 HP x 0,736 x 4 H x 0,502F = 17,73 Frs
Eau	10 m3 x 5,00 F = 50,00 Frs	5,2 m3 = 26,00 Frs
Produits chimiques	273 kg x 15,00 F = 4095,00 Frs	234 kg x 15,00 = 3510,00 Frs
Main d'oeuvre $\frac{1}{3}$	$\frac{80 \times 6,5}{3}$ = 173,00 Frs	$\frac{80 \times 4}{3}$ = 106,00 Frs
Coût calorifique	10m3 de 15° à 45° = 43,00 Frs	5,2 m3 = 21,00 Frs
TOTAL	4421,00 Frs	3680,00 Frs

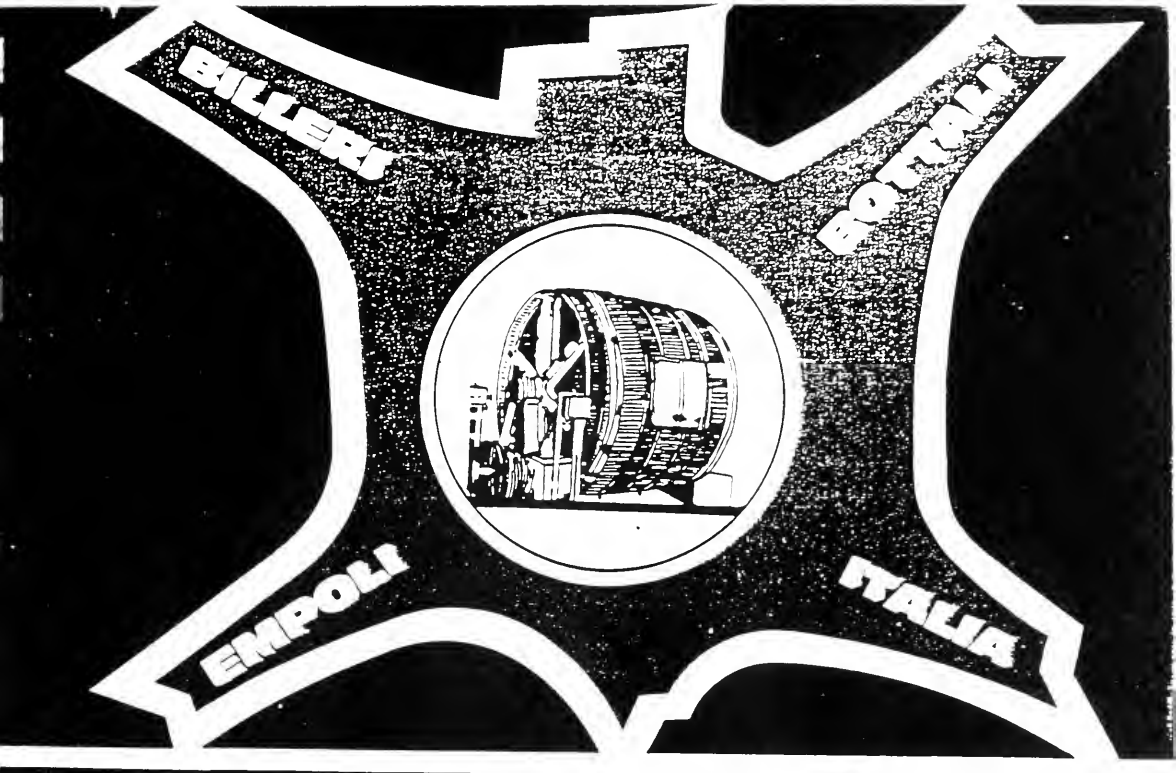
soit une différence de 741,00 Frs

Pour un rendement de 3 pieds au kg on a une économie de $\frac{741 \text{ Frs}}{3000 \text{ pieds}}$ = 0,12 Frs/pied

Pour une mégisserie qui produit 100 000 Pieds par mois l'économie est de
12 000,00 Frs/mois
soit 144 000,00 Frs/an

donc un TANNOX est amorti en $\frac{250\,000}{144\,000}$ = 1,73 an environ soit 21 mois

APPENDIX B - 2



BILLERI RICCARDO

E FIGLI s.p.a.

BOTTALI PER CONCERIE

via Valdorme / EMPOLI / Italia / tel. 710291/2 / Tx 570520 BRF-I

Liming
Soaking
Tanning and
Dyeing
machines

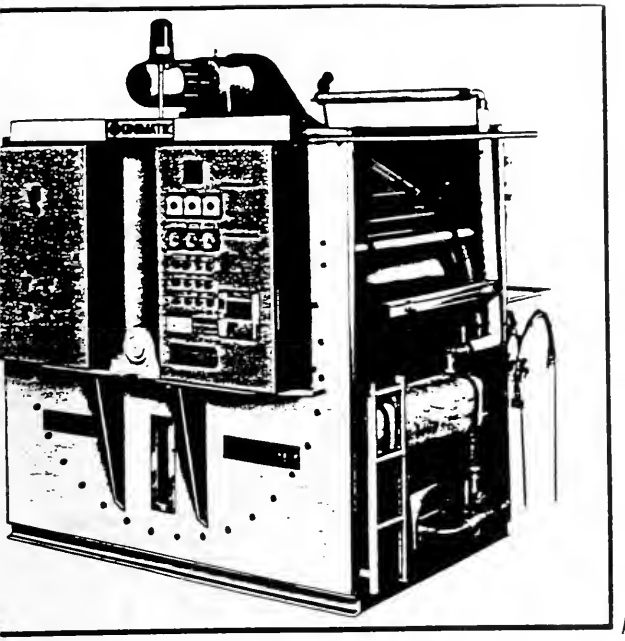
Machines à
Calciner
Tremper
Tanner et
Teinter les
peaux

Máquinas para
reblandamiento-
encalado
Curtido
recurtido
Teñido de
pieles

UNIK-PEL 1000

UNIK-PEL 2000

MACCHINE PER
RINVERDIMENTO
CALCINAIO
CONCIA RICONCIA
TINTURA PELLI



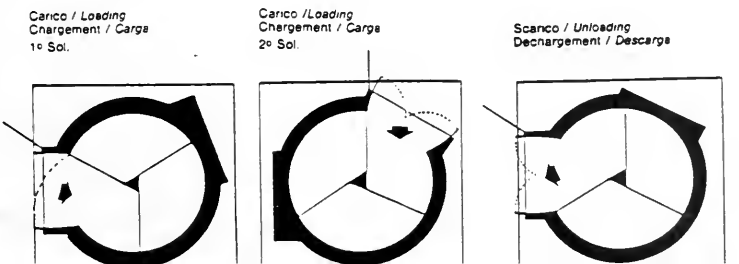
UNIK-PEL
la macchina ideale per i processi conciari

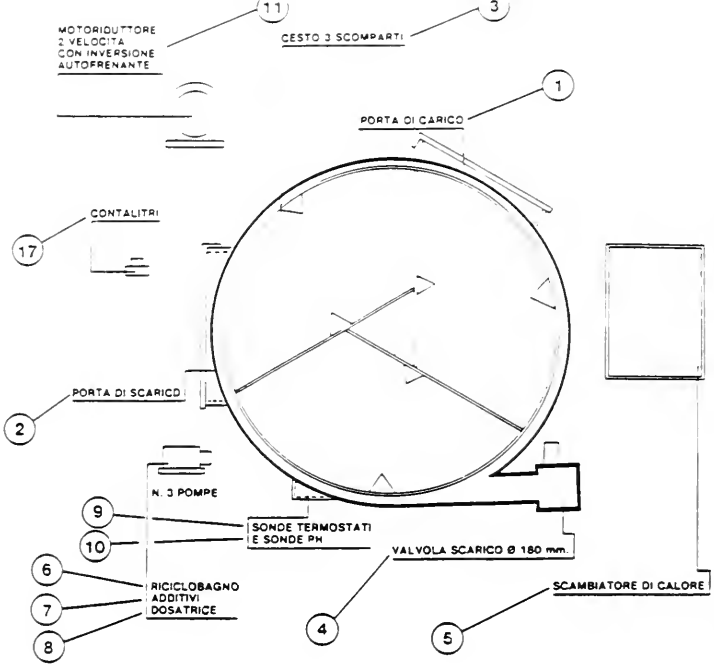
UNIK-PEL The ideal machine for tanning processes
UNIK-PEL La machine idéale pour les traitements de tannerie
UNIK-PEL La máquina ideal para diversos procesos de curtido

tà e costanza di produzione / *Consistent quality*
oduction
te et constance de production / *Calidad y*
ancia de producción
zione dell'inquinamento / *Water pollution reduction*
ction de la pollution / *Reducción del inquinamento*
ori condizioni di lavoro / *Better working conditions*
eures conditions de travail / *Mejores condiciones de trabajo*

ne dei costi di lavorazione
on of process costs
ion des coûts des traitements
ión de los costes de trabajo

- Acqua
  Water
  Eau
  Agua
- Calorie
  Calories
  Calories
  Calorias
- Energia elettrica
  Electrical power
  Energie électrique
  Energia eléctrica
- Mano d'opera
  Labour
  Main d'oeuvre
  Mano de obra
- Additivi chimici
  Chemicals
  Additifs
  Aditivos químicos
- Tempi di lavorazione
  Cycle times
  Temps de travail
  Tiempos de trabajo

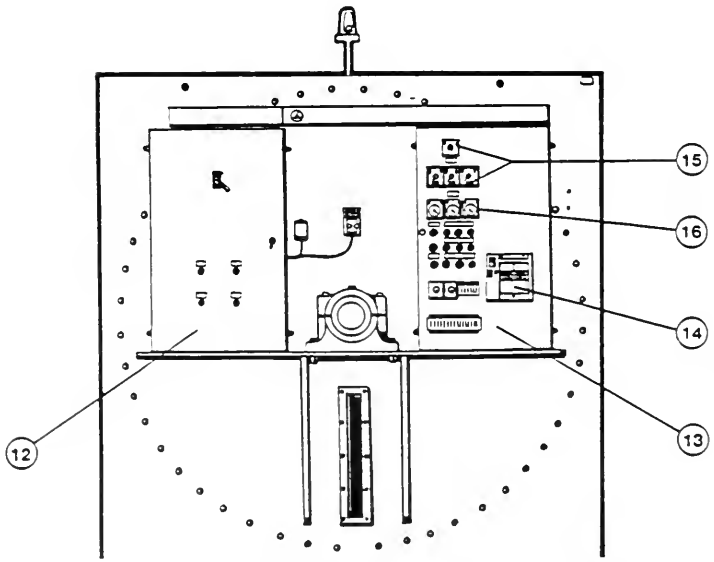




1 Porta di carico
2 Porta di scarico
3 Cesto a 3 scomparti
4 Valvola di scarico
5 Scambiatore di calore
6 Pompa di riciclo
7 Pompa rapida additivi
8 Pompa lenta dosatrice
9 Sonde per termostati (N. 2)
10 Sonda per Ph metro (N. 1)
11 Motoriduttore autofrenante
12 Quadro di potenza
13 Quadro di comando
14 Programmatore a scheda perforata
15 Regolatore di temperatura
16 Contaimpulsi
17 Contalitri

1 *Loading door*
2 *Unloading door*
3 *3 Compartment drum*
4 *Discharge valve*
5 *Heat exchanger*
6 *Recycling pump*
7 *Fast self-priming pump for chemicals*
8 *Slow dosing pump for chemicals*
9 *Temperature sensors (N. 2)*
10 *Ph sensor (N. 1)*
11 *Self braking geared motor*
12 *Electrical power panel*
13 *Control board*
14 *Punch card programmer*
15 *Temperature regulators*
16 *Liter counters (N. 3)*
17 *Water meter*

1 Porte de chargement
2 Porte de dechargement
3 Panier divise en 3 compartiments
4 Valve d'ecoulement
5 Echangeur de chaleur
6 Pompe de recycle
7 Pompe rapide autoamorceuse pour additifs
8 Pompe lente de dosage pour additifs
9 Sondes pour thermostats (N. 2)
10 Sonde pour Ph metre (N. 1)
11 Motoreducteur auto-freinant
12 Tableau de puissance
13 Tableau de commande
14 Programmeur par carte perforee
15 Regulateurs de temperature
16 Compte-impulsions (N. 3)
17 Compe-litres



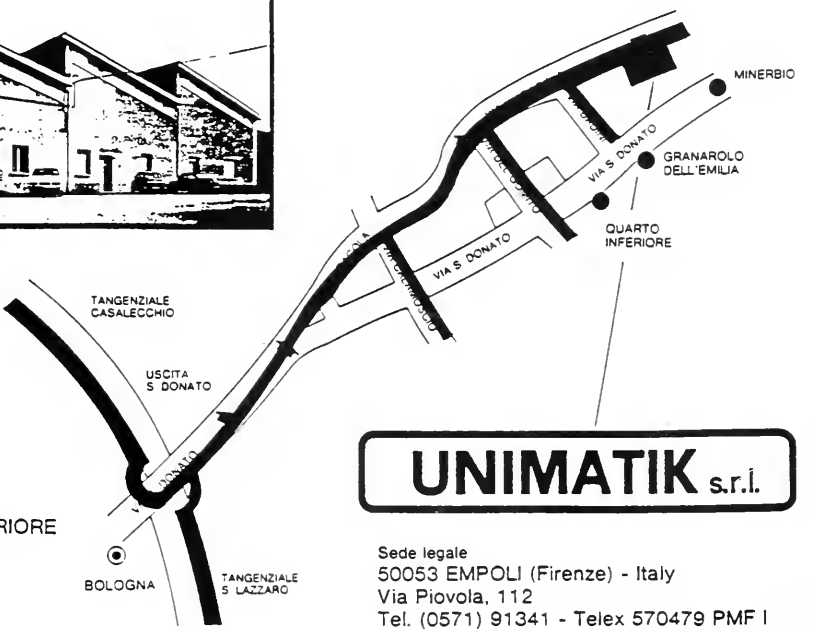
1 *Puerta de carga*
2 *Puerta de descarga*
3 *Cesta con 3 divisiones*
4 *Válvula de descarga*
5 *Intercambiador de calor*
6 *Bomba de reciclo*
7 *Bomba rapida aditivos*
8 *Bomba lenta dosificadora*
9 *Sondas para termostatos (N. 2)*
10 *Sonda para Ph metro (N. 1)*
11 *Motoreductor autofrenante*
12 *Cuadro de potencia*
13 *Cuadro de mandos*
14 *Programador con fichas perforadas*
15 *Reguladores de temperatura*
16 *Cuentaimpulsos*

Caratteristiche tecniche delle macchine UNIK-PEL
Technical data of UNIK-PEL machines
Données techniques des machines UNIK-PEL
Características técnicas de las máquinas UNIK-PEL

Carico/scarico radiale
Radial loading/unloading
Chargement/dechargement radial
Carga/descarga radial

Modello	Model	Modele	Modelo	1000 ASA	2000 ASA
Cesto	**Basket**	**Tambour**	**Cesto**		
diametro	diameter	diametre	diametro	1500	1500
profondita	depth	profondeur	profundidad	670	1140
volume	volume	volume	volumen	1200	2015
n.comparti	n.partitions	n.compartiments	n.compartimientos	3	3
Botte	**Drum**	**Tonneau**	**Fulón**		
diametro	diameter	diametre	diametro	1650	1650
profondita	depth	profondeur	profundidad	865	1335
volume	volume	volume	volumen	1900	3030
Dimensioni	**Overall dimensions**	**dimensions**	**dimensiones**		
lunghezza	lenght	longueur	largo	2500	2500
profondita	depth	profondeur	profundidad	1500	2000
altezza	height	hauteur	altura	2200	2200
peso	net weight	poids net	peso	2800	3600
CAPACITA	**CAPACITY**	**CAPACITE**	**CAPACIDAD**		
peso asciutto	dry weight	poids sec	peso seco	100 Kg.	200
peso rasato	shaved weight	poids rase	peso liso	250 Kg.	500 Kg.
Collegamenti	**Connections**	**Connexions**	**Conexiones**		
acqua fredda/calda	cold and hot water	eau froid et chaude	agua fria/caliente	2"	2"
vapore	steam	vapeur	vapor	1"1/4	1"1/4
scarico	draining	vidange	descarga	mm. 150	mm. 230
installazione	installation	installation	instalacion	5	10
Potenza motore	**Motor power**	**Puissance moteur**	**Potencia motor**	3	5.5
Numero giri	**Rorations per minute**	**Nr.tours per minute**	**Nr. de vueltas por minuto**	3/22	12/24
Livelli acqua	**Water levels**	**Niveaux eau**	**Niveles agua**	3	3
teletermostati	telethermostats	telethermostats	teletermostatos	3	3
entrata additivi	chemicals inlet	entree additifs	entrada aditivos	8	8

Le descrizioni ed illustrazioni del presente catalogo sono fornite a semplice titolo informativo. L'UNIMATIK perciò si riserva di modificare i dati tecnici, dei suoi modelli.
Descriptions and data of this catalogue are supplied for information only and are not binding. Messrs UNIMATIK reserve the right to modify data the manufacturing and technical information of her models at any time



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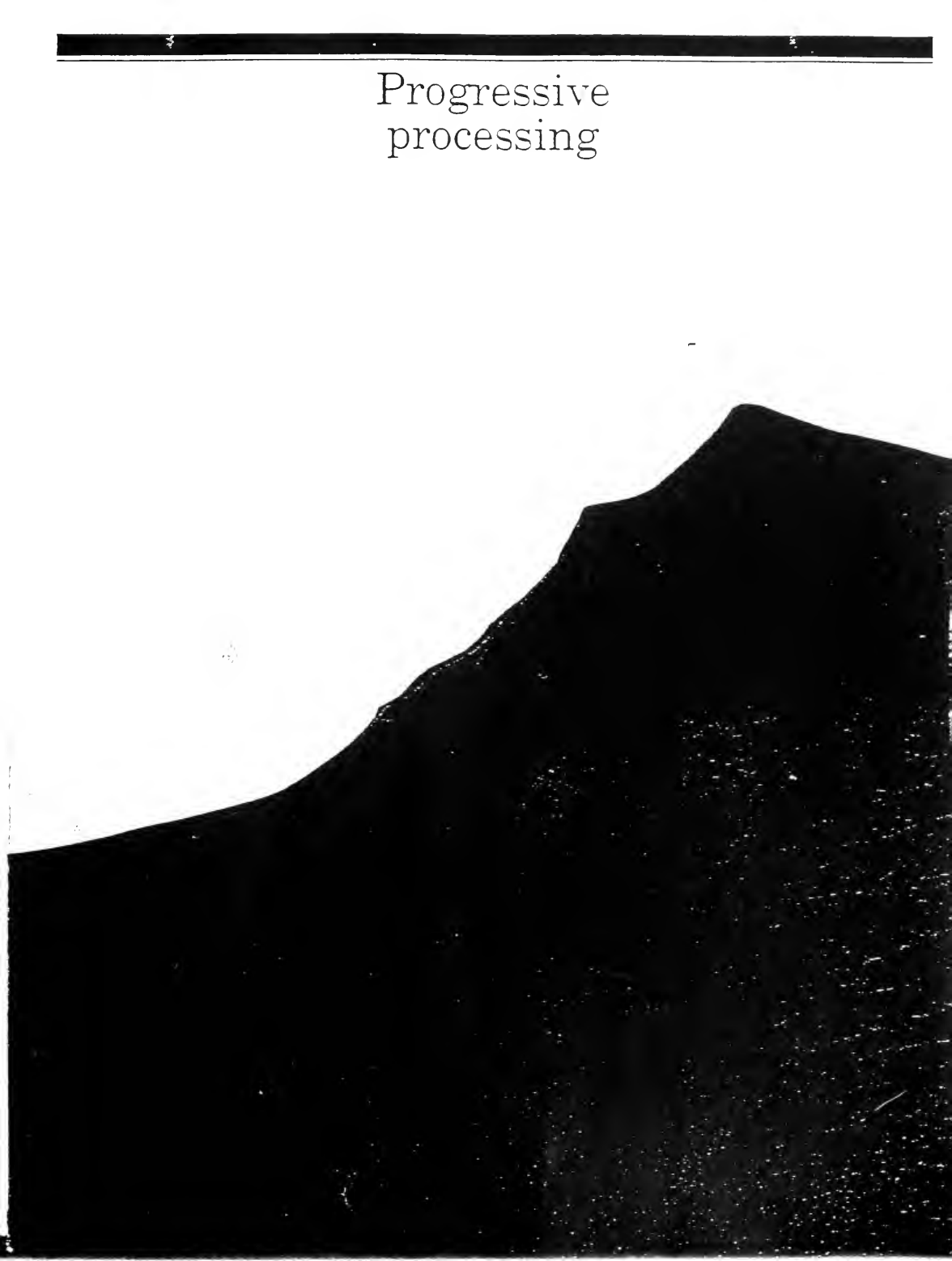
stayer grafch. - granarolo (bo)

APPENDIX B - 3

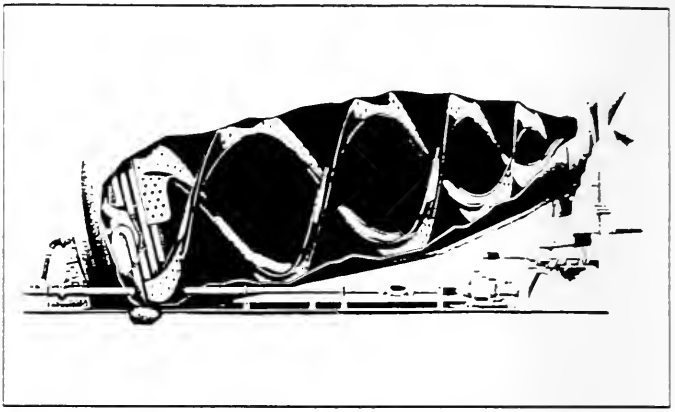
Progressive processing



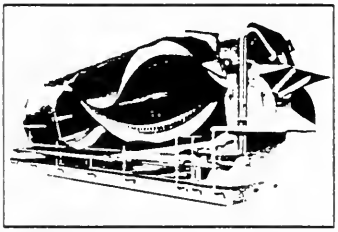
Processing with precision

The Challenge hide processor concept is based on an inclined axis mixer principle. In operation its action is gentle yet intensive, producing significant benefits.

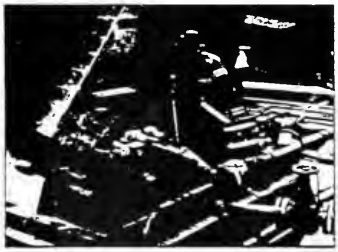
- Chemical addition is precise and thorough, providing optimum chemical usage. An improved grain quality is achieved, as well as reduced costs.
- Simple and effective temperature control eliminates potential damage to raw material.
- Water consumption and effluent are substantially reduced.
- Fast loading and unloading by forklift or conveyor provides considerable savings in personnel requirements, and reduces downtime.
- Relatively few moving parts mean minimal maintenance requirements.
- Reduced process times and operational simplicity lead to improved working conditions and labour savings.
- Rotational speed can be controlled to suit all types of complete process.



Great versatility and a gentle yet intensive action are direct results of the Challenge double helix design concept.



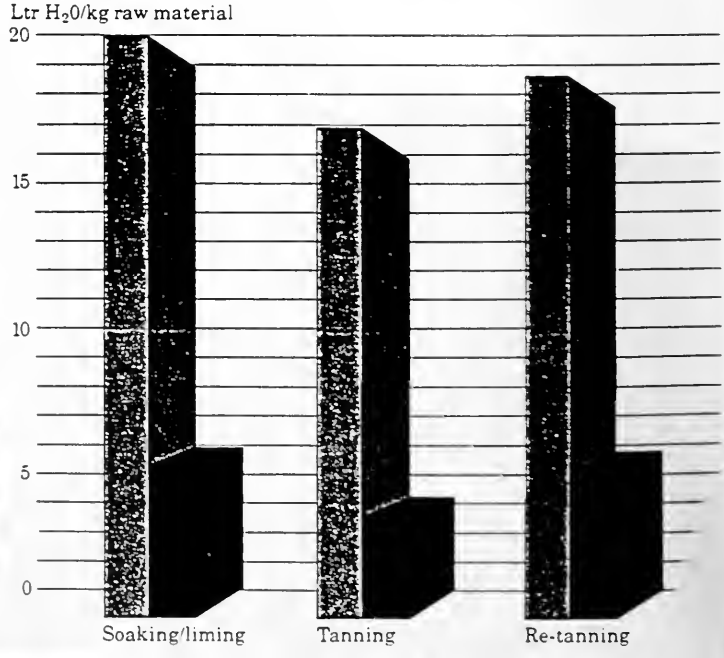
State-of-the-art processing represented by the two compartment HP-304/SS-Twin.



Robust and energy efficient, the drive unit has proved its reliability on over 1800 units.

Comparison of water consumption

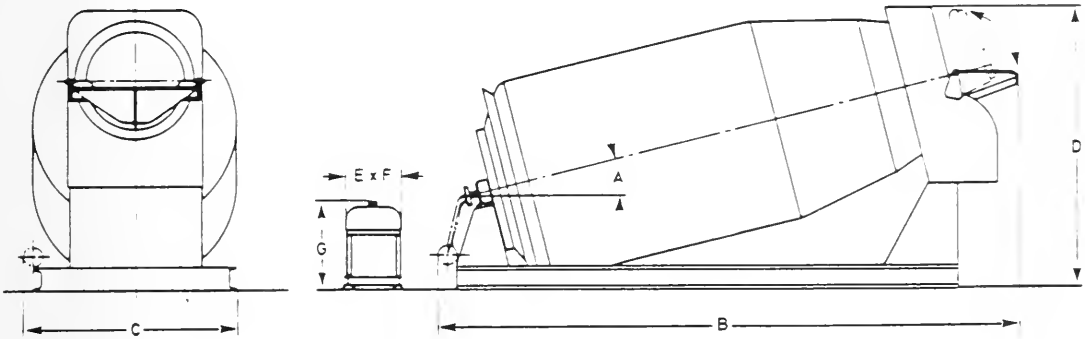
In comparison with paddles and drums the reduction in water consumption is drastic, as this chart – adapted from an independent study – clearly shows.



Range specifications

PROCESSOR		HP-42	HP-82	HP-153	HP-203	HP-303	HP-403	HP-304 Twin
Gross Drum Volume	cu.m	6.3	10	16	21	25	30	26.5
Water Level Capacity	liters	2700	4500	7500	12000	15500	18000	13700
Operating Speed	RPM	0-15	0-15	0-15	0-15	0-15	0-15	0-15
Angle of Inclination	A. Degrees	14	14	14	14	12	11	9
Overall Length	B.mm	3810	4530	6110	7010	7960	9090	8615
Overall Width	C.mm	2000	2000	2480	2480	2480	2480	2480
Overall Height	D.mm	2370	2500	3130	3350	3350	3350	3150
Weight	Net kg	2900	3400	5650	6400	7350	7950	8850
Main Motor	kW	5.5-11	7.5-15	15-22	22-37	30-45	37-45	37-45
Pump Motor	kW	2.2-4	2.2-4	4-5.5	4-5.5	4-5.5	4-5.5	4-5.5

Power unit for HP-42 and HP-82: ExFxGmm-580x1050x730
Power unit for HP-153, HP-203, HP-303, HP304: ExFxGmm-800x1600x1080



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APPENDIX C

SUGGESTED SODIUM LOADINGS

SUGGESTED CRITERIA RELATION TO SODIUM ADDITION TO ONTARIO SOILS

January 1981

Excessive amounts of sodium in a soil can cause the fine particles such as clay, organic matter and silt to disperse. This can plug the network of spaces between soil particles impeding the entrance of water, oxygen and plant roots, severely restricting crop production. Once the soil has dispersed it is very difficult and costly to correct the problem so prevention is important. Excessive soluble salts in a soil can also result in poor crop growth or complete elimination of crops.

Ontario soils are naturally low in sodium and in soluble salts. Moderate amounts of added sodium and soluble salts will leach from the soil over time provided drainage and soil structure are adequate.

Amounts of sodium added to soil in crop refuse, livestock manure and sewage sludge are normally small and unlikely to cause problems. Damaging amounts of sodium do occasionally reach Ontario soils through road salt drainage from highways or storage areas and in byproducts such as certain food processing wastes. The following criteria were established as a guide to what products can be safely applied to soils from a sodium standpoint and the rates that may be used without damaging soil structure or reducing crop growth.

1. The sodium adsorption ratio (SAR) of the soluble fraction of material added to soils should be less than 5. For fluid wastes this should be measured on the filtrate. On solid wastes it should be measured on the saturation extract or on the filtrate of a 2:1 water-soil suspension.

$$SAR = \frac{Na^{+}}{\sqrt{(Ca^{++} + Mg^{++})/2}}$$

In some cases it may be possible to correct an unacceptable SAR by addition of soluble calcium.

2. The maximum annual sodium additions considered safe to add to Ontario soils without causing serious damage to soil structure or reducing crop growth are presented in Table 1.

Table 1: Suggested Maximum Annual Sodium Additions to Ontario Soils

Soil Texture	Annual Maximum Sodium Addition kg/ha
sands, sandy loams, organic soils	400
loams, clay loams, clays	1000

Where sodium additions are greater than 50% of those specified in Table 1 the following conditions should also be met.

(1) Soils should be well or imperfectly drained or tile drained.

(2) After two years of application soil sodium and electrical conductivity of the soil solution should be monitored annually. Soil sodium should not be allowed to exceed five percent of the exchange capacity. Conductivity may be measured on a saturation extract or a 2:1 water to soil suspension and should not exceed 2000 μ mhos/cm in the saturation extract or 800 μ mhos/cm in a 2:1 water to soil suspension.

The pH of any material applied to an established crop should not be above 8.5.

Since sodium problems are rare in Ontario these criteria are based largely on experience elsewhere with only limited Ontario data. Research is needed to verify or modify the above criteria.

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